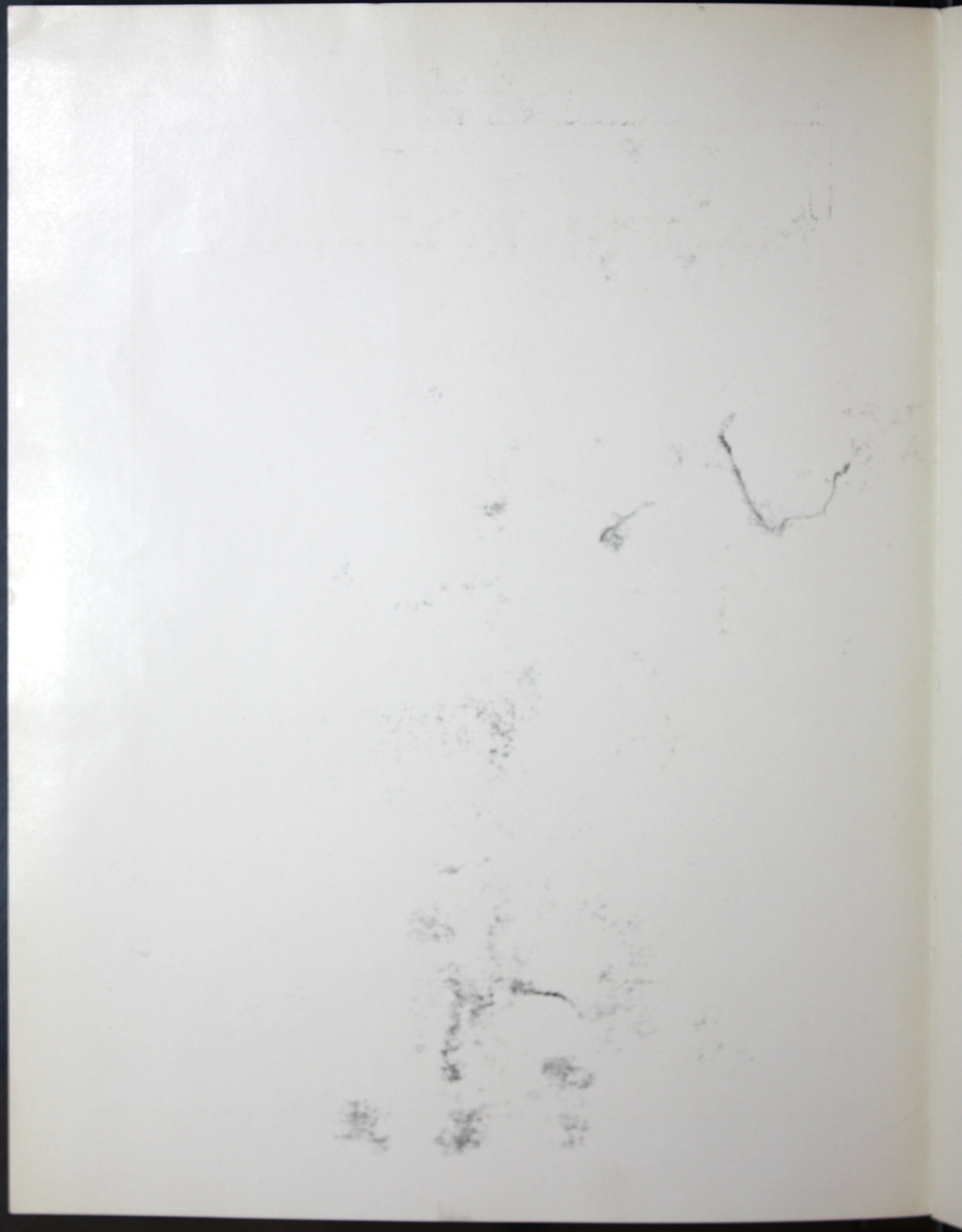


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STEEL ROOFING

Its Use and Application





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STEEL ROOFING

ITS USE
AND APPLICATION



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SHEET STEEL TRADE EXTENSION COMMITTEE

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STEEL ROOFING

ITS USE
AND APPLICATION





WHEN prehistoric man decided he was superior to the beasts he could conquer and that he should no longer live like one in a cave, his first thought in building a new shelter may very well have been of the roof. For roofing material he chose the bark of trees, skins of animals or perhaps young saplings interwoven with grass or reeds. In any event, deciding upon a suitable protective covering to keep out snow and rain or to afford shelter from a tropical sun presented a problem in the early development of man that still is claiming the studious attention of modern builders.

Today we demand something more of a roof than temporary shelter. We want durability, long life, low maintenance, attractiveness, ease of application and, equally important, fire and lightning protection.

This book tells how steel roofing is manufactured, lists its many advantages, illustrates its wide use, and explains how a buyer can make certain of

getting the proper quality of steel to insure the most lasting and satisfactory service.

In rural districts where skilled mechanics may not be available, those buyers who so desire will find it easy to apply the more common forms of steel roofing on buildings of simple design.

Application of the more difficult types of steel roofing on buildings of elaborate design requires the services of the local sheet metal contractor, tinner or experienced mechanic.

Send for your free copy of any of the following books which explain in detail how to measure a roof, how to figure and order the exact amount of steel required, and illustrate, with actual step-by-step construction pictures, exactly how to apply it:

- "Corrugated Roofing"*
- "V-Crimp Roofing"*
- "Pressed Standing Seam Roofing"*
- "Self-Capping Roll Roofing"*
- "Double Standing Seam Roofing"*
- "Metal Shingles"*
- "Spanish Metal Tile"*
- "Barn Ventilators"*

SHEET STEEL TRADE EXTENSION COMMITTEE. OLIVER BUILDING, PITTSBURGH, PA.



THE Sheet Steel Trade Extension Committee, an educational organization founded for the purpose of improving and extending the uses of sheet steel, will enjoy the opportunity of furnishing you, without obligation, any desired information concerning sheet steel and the thousands of products made from it. A post card request will receive prompt attention.

Deciding On a New Roof

INVESTIGATE before you invest," applies to roofing material as well as it does to stocks and bonds. Before buying any kind of roofing material for your house, garage, barn, corn crib, machine shed, hog pen, chicken house or other building there are some questions to be asked, and satisfactorily answered.

Is it durable? How long will it last? How much attention does it require to keep it in good condition? Is it easy to apply?

Is it of such composition that it will quickly lose its "life," dry out, curl up or crack under the hot rays of the sun? Will snow and rain cause it to rot in a few years and require replacement?

What protection, if any, does it provide against fire and lightning? Is it the kind of a roof that can laugh at the worst electrical storm and get away with it? Will high winds tear it loose and expose the contents of the building to damage by water?

Finally, is it truly economical? Will it render a dollar's worth of service for every dollar it costs? Saving ten dollars on the purchase price of a roof and then spending twenty dollars the second year on repairs or replacements is not economy, but extravagance.

Asking "How much does a roof cost?" is like asking "How much does a suit of clothes cost?" Quality roofing, like an all-wool suit, usually brings a slightly higher purchase price, but always costs less in the end.

Galvanized Steel for Roofing

Because iron, and later steel, has served mankind so long, so faithfully, and so extensively as a basic material, it is taken for granted like the rising and setting of the sun, or the coming and going of winter and summer. Because it is so readily available in thousands of forms, procuring it in any one of these forms to satisfy human need never requires a second thought. Whether it be a pocket knife or a reaper, an automobile or a locomotive, an ocean liner or a modern skyscraper, a shoe horn or a milk pail, man's requirements of steel are quickly met. Without steel, living as man is accustomed to live today would be impossible.

How, when and where iron was first discovered is not revealed in even the most ancient records of civilization. Perhaps some nomad, disturbing the

cold ashes of a fire built the night before on a soil rich with ore, accidentally discovered a lump of some substance that obviously was different from anything he had seen before. Because "curiosity rules the world" man progressed, and next we learn of a hole in a clay bank where a crude bellows of goat skin was used to create a blast and thus raise the temperature of the burning charcoal to a point where it would reduce the ore to crude iron. This modest start nearly a hundred centuries ago is reflected today in the modern blast furnace producing 800 tons of pig iron every twenty-four hours.

On pages 6 and 7 are illustrated fourteen steps in the modern manufacture of sheet steel.

Giant steam shovels gouge great craters into the earth in removing the ore which lies near the surface. Lake freighters as long as a city block convey this ore to lower lake ports where mechanical unloading devices that are almost human in their accomplishments take the ore from the hold of the vessel and load it into freight cars or place it on stock piles preparatory to further shipment to the mills.

When iron ore, coke and limestone are dumped into the top of a blast furnace and subjected to terrific heat, the molten metal drawn off at the bottom of the furnace is called "pig iron."

To make steel, this pig iron is then placed in an open hearth furnace or a Bessemer converter where impurities are burned out and further refinement accomplished.

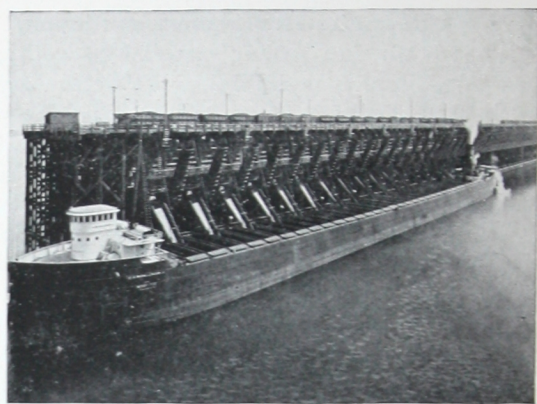
The molten steel from either the open hearth furnace or Bessemer converter is poured into huge ingot molds. After it cools sufficiently, the molds are removed. Because the ingots have cooled more rapidly on the outside than on the inside, it is necessary to place them in a huge furnace called a "soaking pit" where they are raised again to a uniform temperature throughout. They are then ready for the "blooming" mill which is the first rolling operation.

After being passed back and forth several times through the blooming mill, what was formerly an ingot emerges in a long piece of metal called a "bloom." The shape of these blooms is changed by additional rolling in a bar mill or slab mill, from which the metal emerges in the form of bars, slabs or billets. "Billets" are rolled into merchant bar,

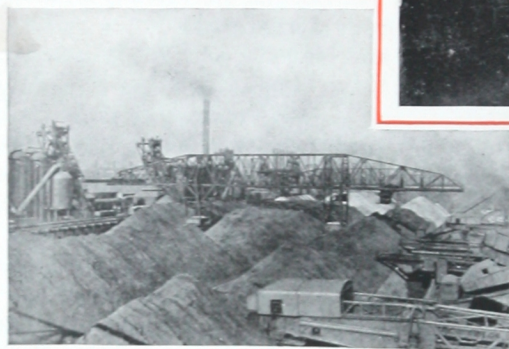
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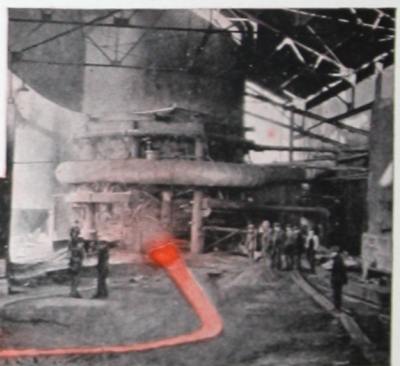
No. 1—Removing iron ore from Mother Earth in Lake Superior region. (above)



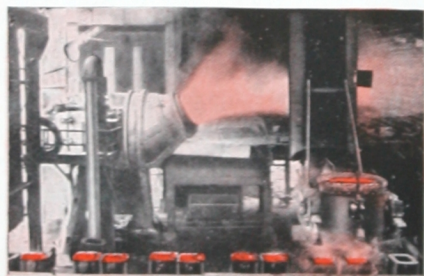
No. 2—Mammoth freighters bring ore down the lakes.



No. 3—Unloading ore at lower lake ports. (at right)



No. 4—Molten pig iron runs out at the bottom when blast furnace is "tapped."



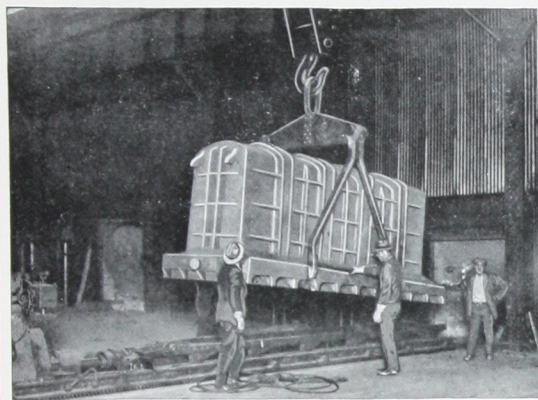
No. 5—Pig iron becomes steel in Bessemer "converter." Ingot moulds being poured in foreground.



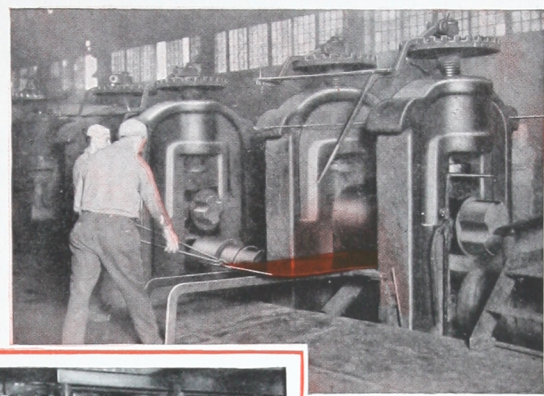
No. 6—Battery of open hearth furnaces converting iron into steel.



No. 7—"Blooming mill" where steel ingots are put through the first rolling process.



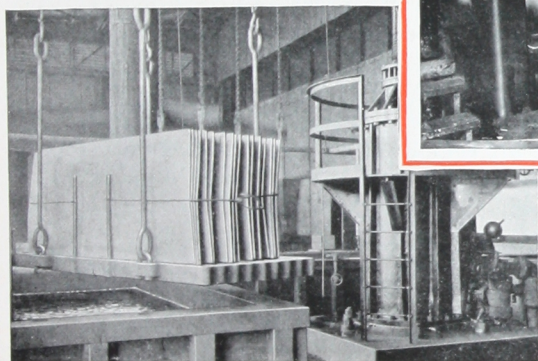
No. 9—Sheets are heated in this annealing box to make them soft and workable.



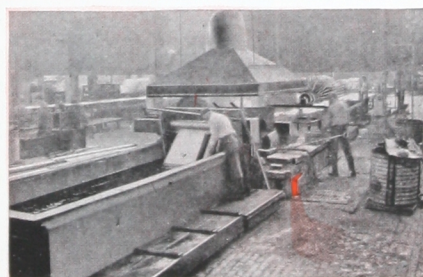
No. 8—Red hot steel bars are rolled into sheets on this hot mill (above).



No. 11 — Passing Sheets through cold rolls gives them a surface finish. (at left)



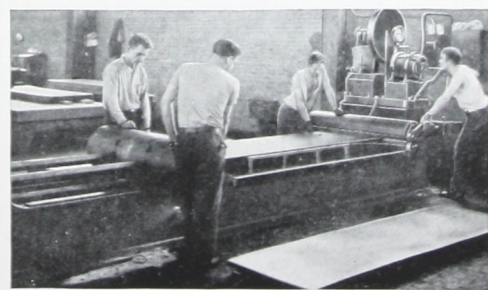
No. 10—Dipping sheets into pickling vat to remove any surface impurities.



No. 12—Coating steel sheets with zinc in the galvanizing pots.



No. 14—Fast quantities of steel sheets in stock room make prompt shipments possible.



No. 13—Sheets are made perfectly level in this "stretcher leveler."

wire, rods, etc. "Slabs" are rolled into a ribbon-like form called "skelp" from which steel pipe is made. "Bars" are cut up into various lengths which, after reheating, are ready for the sheet mills. These are called "sheet bars."

When these sheet bars, red hot, are passed between the large and heavy rolls in the sheet mills, they are flattened out into sheets having different lengths, widths and thicknesses. The thickness of the sheet is called its "gauge." From this point the treatment of the sheet is determined entirely by the use to which it is to be put.

The various processes by which the manufacturer obtains widely varied results are shearing, cold rolling, pickling, annealing, leveling, bluing, polishing, forming and coating. These operations may be varied in number and order and modified in character, so as to turn out sheets that will have the peculiar properties necessary for many individual requirements.

Sheets for galvanized roofing are put through the shearing, annealing, pickling and galvanizing operations. "Shearing" makes the edges true and even. "Annealing" makes the sheets pliable so that they may be readily formed. "Pickling" is a cleansing operation which removes all surface impurities if any have accumulated. After the sheets are pickled and washed they are dipped into pots containing molten zinc and thoroughly coated on both sides and all four edges. This product, called "galvanized" sheet steel has the strength of steel plus the weather-protective properties of zinc.

Steel Roof Laughs at Lightning

With lightning causing more than one-eighth of the total farm fire loss, and with these losses exceeding \$150,000,000 in 1926, the lightning-protective and fire-protective qualities of a steel roof are of major importance, particularly to rural dwellers.

The Committee on Farm Fire Protection, of the National Fire Protection Association, estimates the annual farm fire loss due to lightning at \$20,000,000. Between 400 and 500 persons are killed, and more than 800 are injured every year on farms by lightning, according to the Committee. It is significant that there are nine times as many fires caused by lightning in rural districts as in the city.

The committee has the following to report concerning metal roofs:

"A substantial metal roof, with all parts thereof in good electrical contact can, ac-

cording to available evidence, be utilized as a part of a lightning protection system for a building, and thus in part be made to serve a double purpose. The cost of grounding and making other necessary electrical contacts with interior masses of metal is relatively small. The cost of lightning protection is more than justified when the added personal safety and avoidance of temporary deprivations as well as the saving of property are considered."

In the city, fire fighting is highly developed. Motorized fire apparatus usually is located only a few minutes away from any dwelling in the average thickly populated community. In the country, the bucket brigade frequently is the only means of combating a fire. Often the farmer and his family, helpless in comparative isolation, do not have sufficient warning to save even the live stock or personal belongings.

The three photographs on page 9 tell the story of lightning better than a whole volume of words. Darting, without warning, out of a stormy sky, lightning struck the spark that set these buildings afire. Far removed from the protection of city fire fighting equipment, the owners could do little else than stand by and see the work of years going up in smoke.

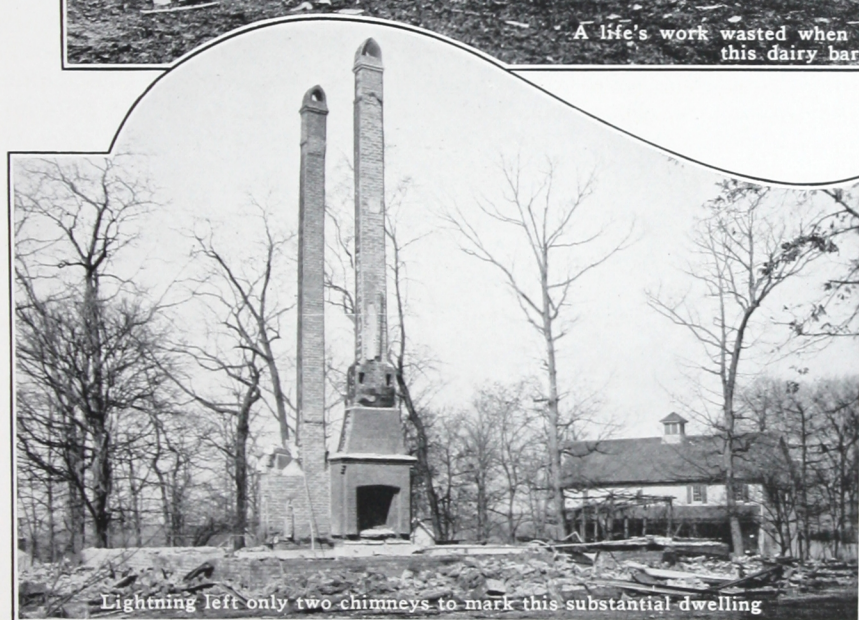
A sheet steel roof, properly grounded, would have prevented these fires.

How Scientists Study Lightning

Because lightning gives no advance warning as to where and when it is going to strike, scientists have been unable to study its actions in the fullest detail in the field. It has been necessary, therefore, to go into the laboratories and create conditions as closely as possible approximating those found under actual circumstances. By generating high voltages, often running more than a million, and by properly controlling these voltages, scientists have been able to cause sparks to jump 20 feet or more, accompanied by terrific thunder claps.

One of the leaders in this study of the cause and effect of lightning was the late Dr. Charles P. Steinmetz, Chief Engineer of the General Electric Company, and recognized the world over as an authority on lightning.

After many experiments Dr. Steinmetz reported that sheet steel roofs, properly grounded, were safe from lightning. He explained that thoroughly



grounded steel roofs tended to relieve by "silent discharges" the electric strain always existing between earth and sky during a thunder storm. He pointed out that buildings thus protected may be struck by lightning, but that the people inside of them never know of it because the discharge is "instantly and silently" carried into the ground and dissipated.

Laboratory experiments have been made by other students of lightning. On page 11 is clearly portrayed the lightning protective merits of a sheet steel roof. In this experiment, electrical equipment was constructed capable of producing an electrical discharge of thousands of volts. Miniature barns 18 inches long, 12 inches wide and 12 inches high at the peak were packed with hay to simulate conditions as found in the ordinary farm barn. An electric conductor was connected to the edge of the roofs in each case and was extended below the bottom of the siding. Six popular kinds of present day roofing were used in the experiments, one of them being sheet steel. The others we will call A-B-C-D and E. In each case the roofing material was supported by 7/8 inch sheathing boards.

Two wires were arranged, one carrying the discharge and suspended about 10 inches above the roof; the other acting as a return wire and located the same distance beneath the miniature barn. When the laboratory-manufactured lightning was discharged from the upper wire, it sought the quickest and easiest route to the return wire located beneath the barn, just as actual lightning seeks the quickest and easiest route to the ground. The results of the experiments were as follows:

In the case of roofs A-B-C-D and E, the lightning quickly penetrated the roof and, within two seconds, fired the contents of the miniature barns in burning its path to the return wire underneath.

In the case of the steel roof, subjected to the same discharge for 25 seconds, the current traveled down the roof to the corner where it was picked up by the lightning conductor, or "ground" connection. It followed this ground connection down the corner of the building and then jumped to the return wire. Thus the roof and contents of the building were completely protected. This is exactly what happens in the case of lightning striking any building roofed with sheet steel and properly grounded.

Because a sheet steel roof covers *all* of the roof

area, it is the surest protection against lightning. There is no place for the lightning to get through. With a sheet steel roof properly laid and adequately grounded there is no need for any other form of lightning protection. Anything added is an unnecessary embellishment.

How to Ground a Steel Roof

To "ground" a metal roof it is necessary only to provide an easy path for the electrical current called "lightning" to travel from the roof of the building to its ultimate destination, namely, the moist sub-soil of the earth.

The roof must be connected at two or more outstanding corners to upright grounding pipes, bars or cables whose lower ends are well down into the permanently moist earth.

Galvanized steel bars, galvanized pipe or galvanized wire cable one-half inch or larger in diameter will serve satisfactorily as conductors. All joints between the roof and the bars, pipes or cables, and any joints in these bars, pipes or cables must be strongly fastened together in a manner to provide a permanently tight contact which will not rust.

Grounding bars, pipes or cables should run as nearly straight down from the roof as possible with very little change from the general downward direction. Where any change in direction is necessary, it should be gradual and not sudden.

If the building is covered with metal siding, the latter must be attached to the grounding rods. Such siding can be used as a part of the grounding system if the steel roof is securely connected to the siding by metallic connections at a number of places throughout its length. The metal siding must then be connected by bars or cables from its lower end to the ground. This does away with the necessity of extending conductors from the ground to the roof because the siding itself serves this purpose and it is only necessary to provide connections between the lower end of the siding and the moist earth at not less than two diagonally opposite corners of the building.

All projections above a steel roof should be either covered with metal and put in metallic contact with the roof or, as in the case of masonry chimneys, should be protected by a bar attached to the metal roof adjacent to the chimney and extending vertically up along side and above the

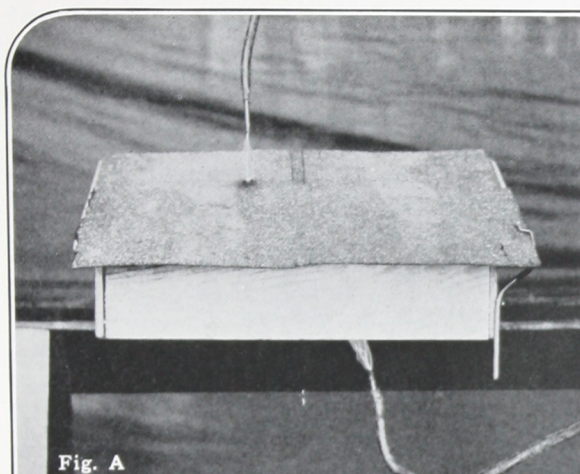


Fig. A

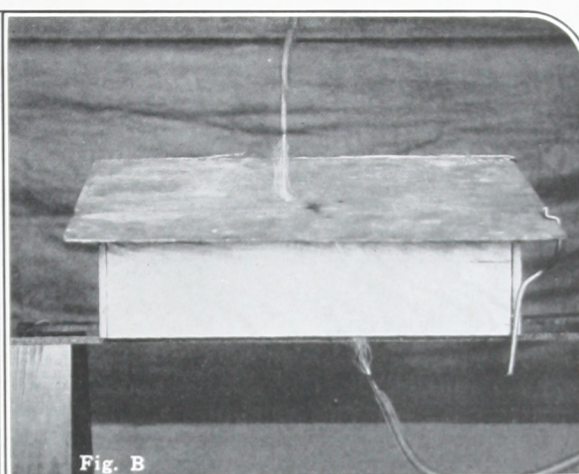


Fig. B

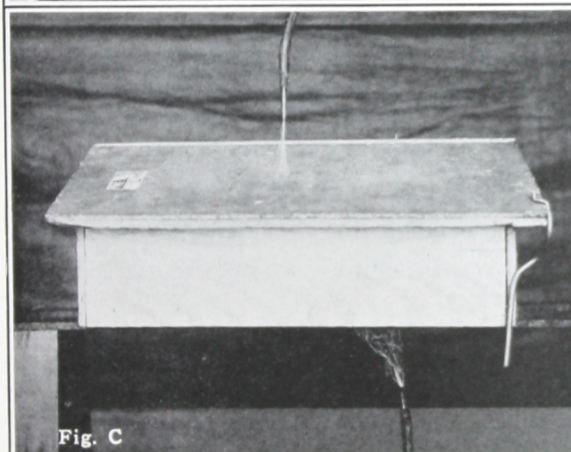


Fig. C

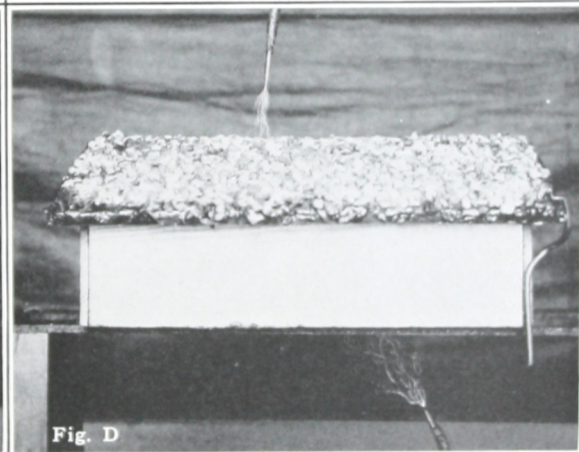


Fig. D

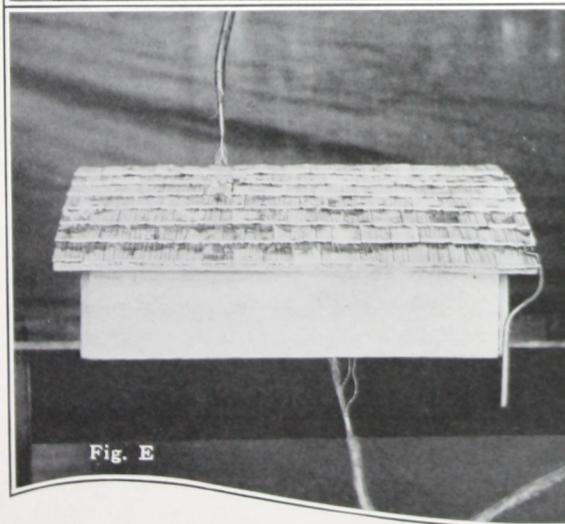
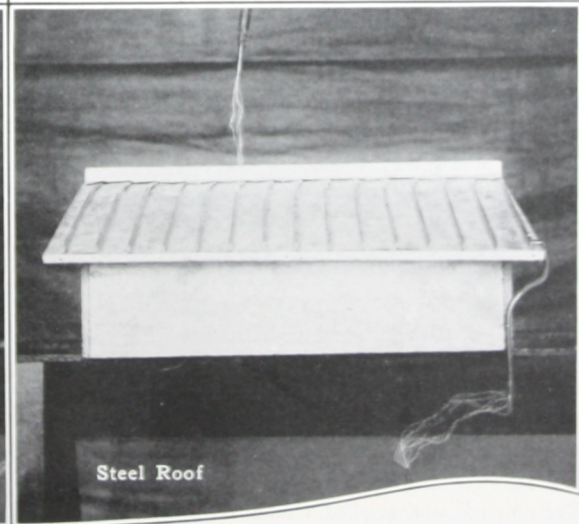


Fig. E



Steel Roof

chimney to a point equal to one half the greatest distance from the bar to any point on top of the chimney. That is to say, if the bar is 20 inches distant from the farthest corner on top of the chimney, it should extend 10 inches above the chimney.

Any large pieces of metal inside the building, such as tanks, large hay forks, tractors, etc., must be connected by bars or wires to either the metal roof, metal siding or to the bar, pipe or cable system used for grounding.

All grounding bars, pipes or cables should be rigidly supported outside of, and at least 2 inches away from the building.

Painting the roof and siding or the grounding bars, pipes or cables in no way interferes with their efficiency as conductors of lightning.

The number of grounding bars, pipes or cables will depend entirely upon the size of the building. Buildings more than 50 ft. long should be grounded at all four corners, while smaller buildings need be grounded only twice, at diagonally opposite corners.

In order that the lightning protective qualities of the steel roof may be perfect, it is necessary that the roof be well laid. Loosely nailed sheets which are in poor contact at either their sides or ends do not provide perfect lightning protection. Loose roofs should be renailed at all joints.

Steel Roof Baffles Fire

A sheet steel roof provides double protection against fire in that it tends to retard any internal blaze as well as preventing the spread of flames from one building to another. A fire already started within a building may smolder and do very little damage until circulation of air is permitted, frequently through a hole burned in the roof. You can't easily burn a hole through steel, and for this reason a galvanized roof acts as a wet blanket, serving to smother the fire unless air in large quantities gains access from some other source, or the timbers supporting the roof are burned away. This is clearly illustrated by one of the photographs on page 13. Here the steel roof retarded the fire and prevented entire destruction of the residence.

This means first, that slow fires starting within a steel building may be more quickly brought under control, and second, that surrounding buildings are not endangered by flying sparks or fire brands

as they would be after a hole had been burned through an ordinary roof.

In addition, a sheet steel roof protects a building from external causes of fire. Red hot soot or burning embers dancing merrily from a chimney of a winter's night can shower down on a sheet steel roof without damage to the building. These flying sparks are common causes of fires. Many types of roofs provide a lodging place for these sparks, and a slight breeze quickly fans them into flame.

Such fires frequently start at night, and, before discovery, have destroyed the building or perhaps a group of buildings, many times with a loss of human life, household effects, live stock or machinery.

There seem to be more possible causes of fire around the average farm than there are around the average city residence. Rapidly moving machinery frequently originates the spark that spells the doom of the well stocked barn. A pebble in a shredder may provoke a dangerous blaze.

Threshers, silo fillers, steam engines and gas engines are such sources of fire. Thoughtless workmen in traveling crews are often careless with pipes or cigarettes. Oily rags or even improperly cured hay may start internal combustion which not infrequently results in fire.

Possibility of the rapid communication of fire is a source of constant concern to property owners not only in thickly populated cities, but also on the farm, where outbuildings frequently and often unnecessarily, are built closely adjoining one another.

In the city the fire chief's never ending problem is how to prevent communication of fires. In the country the farmer has to be his own fire chief, and is faced with the same problem without adequate means of solving it.

On page 13 are three photographs illustrating this phase of the subject.

In the case of the Shreveport, La. conflagration, a fire, starting directly across the street from the fire department, got beyond control and quickly spread throughout the entire neighborhood. A few hours later nothing remained of this residential section but bare chimneys towering above acres of smoldering ruins. It is necessary only to mention the Chicago and Baltimore fires to complete the picture.

Two of the illustrations on page 13 show clearly



Non-Combustible Roof on house at left stopped this fire



How Steel Roof tends to "smother" a fire



Lightning started this fire. Steel Roofing stopped it



Steel Roofing might have prevented this Fire

how sheet steel roofs kept disastrous fires from spreading after several buildings had already been destroyed. In these instances, which are only typical of many others, sheet steel roofing may be given a large measure of credit for preventing communication of fires that might have wiped out the entire community in each case.

The cost of a sheet steel roof is a low premium to pay for the insurance it provides against fire. When it is further considered that some insurance companies are glad to quote lower premium rates where properly grounded sheet steel roofing is used, surely there is reason enough for roofing with steel without considering any of the other numerous advantages afforded by this sturdy material.

Steel Roofing Endures

Just as sheet steel roofing laughs at the worst electrical storms, retards the communication of fire, and enjoys the caress of flying sparks, so does it "stay put" with the utmost faithfulness in the face of heavy winds. In short, it serves as a roof when a roof is really needed.

Most anything in the way of a roof furnishes shade from the sun, but the real need comes in the downpour of heavy rains or on the occasion of severe snow storms accompanied by violent winds. Then substitute roofs many times fail at the crucial moment. Large sections or an entire roof may be torn off, leaks may develop, house furnishings are damaged, hay and grain are ruined, live stock is made ill, and finally comes the realization that a few dollars thought saved on a cheaper substitute roof really were not saved at all, but cast to the winds.

Sheet steel roofs 30 and 40 years old are a common sight, as illustrated on page 15. A sheet of steel cannot dry and curl up under the heat of the sun. Properly painted, it cannot rot or rust out in the dampest climates. It neither absorbs moisture nor develops cracks. And so we find the same kind of steel roofing that has sheltered mankind in all parts of the world for more than a generation is being used even more extensively today on modern buildings of every size and description, as illustrated by the modern high school building shown on page 15.

Where sheet steel, either galvanized or plain, is exposed to the weather as in the case of roofing or

siding, it should be well painted. This not only serves as a protection, but makes possible any number of pleasing color effects and serves to improve the appearance of the building. A good quality of linseed oil paint should be used. Coal tar preparations should never be applied under any circumstances because the acid in the tar damages the metal.

So that the paint will adhere to the steel without blistering, galvanized sheets should be permitted to weather for a few months. Painting should be carried out as soon as the surface gloss is gone. If a properly applied steel roof is given an occasional coat of paint it will outlast the building. The few dollars expense for paint and labor is insignificant when compared to the cost of a new roof. In painting an old metal roof any places attacked by rust should be sand papered before the paint is applied.

Steel Roof is Inexpensive

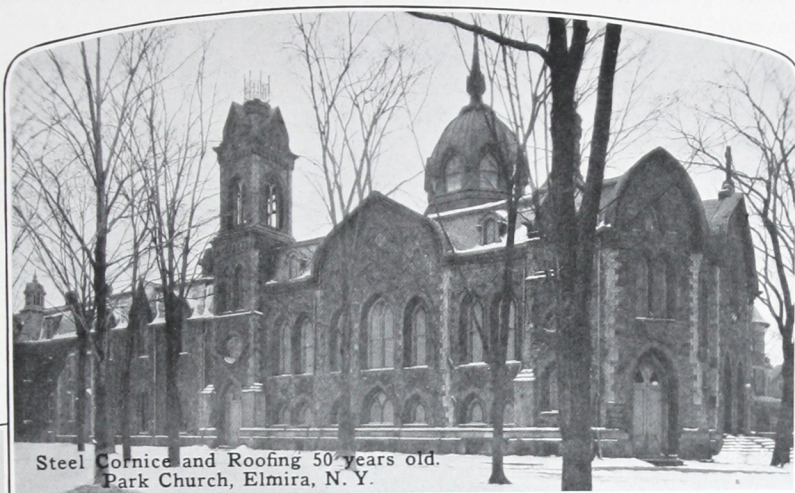
There are cheaper roofs than sheet steel if you consider the purchase price alone, but the purchase price is only the beginning of the story. Galvanized steel roofing of adequate thickness and coating is never "cheap," but it is always "inexpensive." There is a world of difference between the two expressions.

The cost of a roof is its purchase price PLUS the cost of repairs during its life and the interest on your original investment for the same period. When figured on this basis it is easy to understand why the cheapest roof in the beginning—because it requires constant repairing—is the most expensive in the end. Galvanized steel roofs of good quality properly applied and intelligently maintained are the least expensive per year of service.

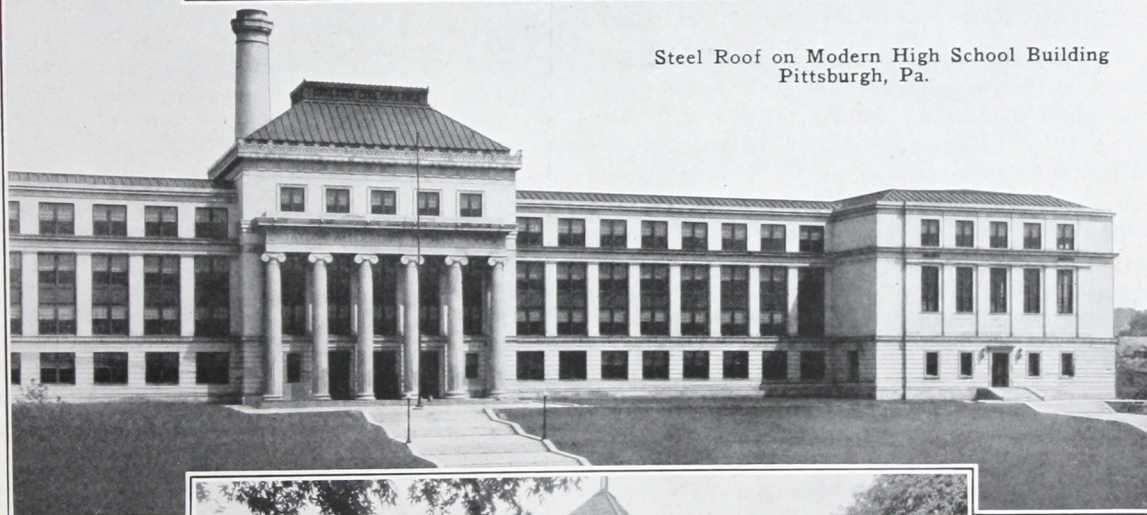
If roofing, like much highway paving, were bought on a ten-year-payment plan, many cheap substitute roofs would be worn out before they were paid for.

A Steel Roof to Satisfy Every Individual Taste

No matter what architectural effect is desired in a roof it can be obtained with some one of the many styles of galvanized steel roofing. For barns and out-buildings, the Corrugated, V-Crimp and Standing Seam types, with their straight lines



Steel Cornice and Roofing 50 years old.
Park Church, Elmira, N. Y.



Steel Roof on Modern High School Building
Pittsburgh, Pa.



Metal Shingles have served for 41 years on
Calvary Episcopal Church, Sedalia, Mo.

running from the eave to ridge, provide a roof of pleasing appearance by reason of their very simplicity. Where more elaborate, artistic effects are wished for, as in the case of dwellings or garages, the sheet steel shingles or Spanish Metal tile leave nothing to be desired.

Today, steel roofing may be found on every type of building in all sections of the world—schools, churches, office buildings, industrial buildings, dwellings, garages and farm buildings. In large cities and small cities, in hot climates or cold climates, in industrial sections or agricultural sections are to be found mute evidences of the long life, low maintenance cost, lightning protection, fire protection and architectural attractiveness of the many available styles of galvanized steel roofing.

Clean Rain Water from Steel Roof

Of especial interest to every housewife in small communities and on the farm is the fact that "soft" rain water shed by a sheet steel roof is unusually clean. With its smooth, hard, non-absorbent surface swept by the breezes and purified by the sun, the sheet steel roof does not harbor dirt and filth. There are no chemicals in the roofing material itself to contaminate the water. There are no lodging places for the foreign matter which fills so many cisterns or rain barrels with impurities.

Popular Types of Steel Roofing

The most popular types of steel roofing are Corrugated, V-Crimp, Pressed Standing Seam, Self-Capping Roll Roofing, Metal Shingles and Spanish Metal Tile. Another widely used type, not easily applied by the layman, is Double Standing Seam Roll Roofing.

Corrugated Roofing is made from flat sheets which have been formed into a series of alternate ridges and grooves, or hills and valleys, that run in the same direction. The reason for corrugating the sheet is to provide the greatest possible stiffness and load carrying ability. This type is illustrated on page 18. The sheet shown in Fig. 1 has corrugations which measure $2\frac{1}{2}$ inches from the top of one to the top of the next. This type is referred to as " $2\frac{1}{2}$ inch Corrugated Roofing." In Fig. 2 the corrugations measure only $1\frac{1}{4}$ inches from ridge to ridge and this type is called " $1\frac{1}{4}$ inch Corrugated Roofing." Both sizes are exten-

sively used and personal taste largely determines the choice.

V-Crimped Roofing is made from flat sheets by forming on each sheet one or more ridges that look like the letter "V" turned upside down. When only one crimp occurs at each side edge of the sheet, it is called 2 V-Crimp roofing. See Fig. 3, page 18.

When another crimp is placed in the center of the sheet, it is called 3 V-Crimp roofing. See Fig. 4, page 18. This provides a stiffer sheet for use in very windy locations.

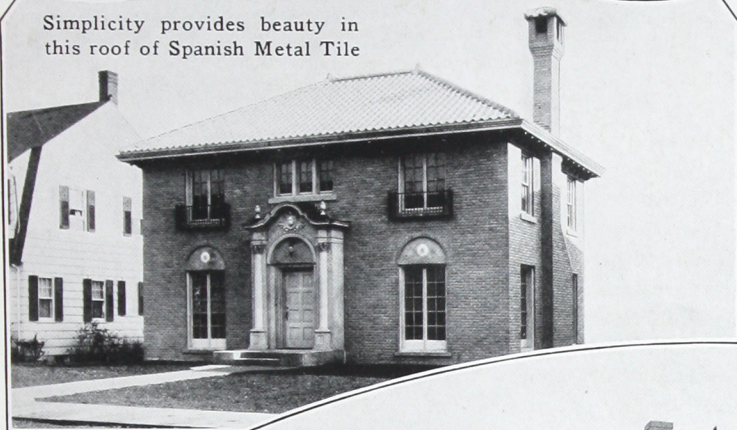
A more common type, using the double crimp along each side, also has a single crimp in the center. These extra crimps provide still greater stiffness and offer further security against water entering at joints. This type is designated as 5-V-Crimp roofing and is shown in Fig. 5, page 18.

Pressed Standing Seam Roofing is somewhat similar to 2-V-Crimp roofing except that the raised portion looks more like the top half of the letter "O" instead of the letter "V." See Fig. 3, page 19. In this type the seam stands slightly higher, making it preferable for use on roofs with a very slight slope or pitch. The higher seam serves as an additional protection against seepage of rain water where the flow of the water from the roof is not as rapid as on a steeper slope.

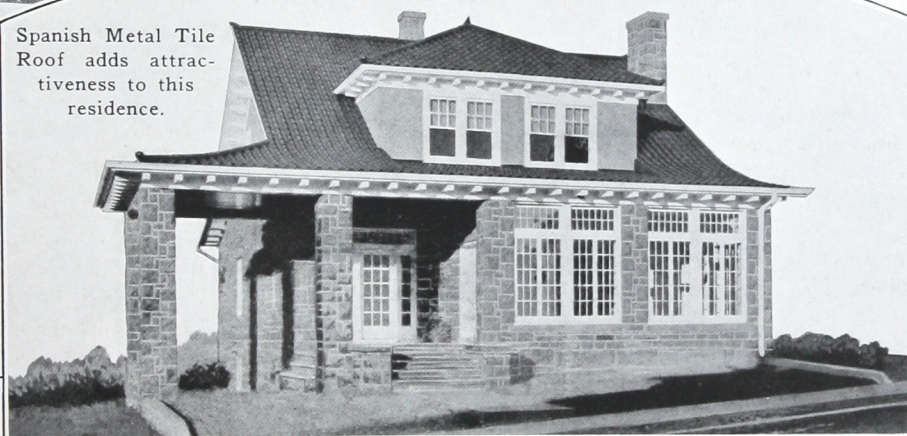
Roll Roofing, as shown in Fig. 4, page 19, consists of several sheets of steel having their ends locked together at the factory by double cross seam locks so as to form one sheet 50 feet long. The customary width is $26\frac{1}{2}$ inches and each roll has a net covering area of 100 square feet when laid. To facilitate handling, the long sheet is put up in the form of a roll. The flanging treatment of the side edges of the sheet when unrolled determines whether it will become Self-Capping Roll Roofing or Double Standing Seam Roll Roofing. One edge of the sheet is turned up to form a flange about $1\frac{1}{2}$ inches high. The other edge is given a flange only one inch high. All sheets are flanged alike and laid on the roof side by side in such manner that the tall flange of one sheet butts up against the short flange of the adjacent sheet.

When the taller flange is bent down over the shorter flange the seam thus formed gives this type the name "Self-Capping Roll Roofing."

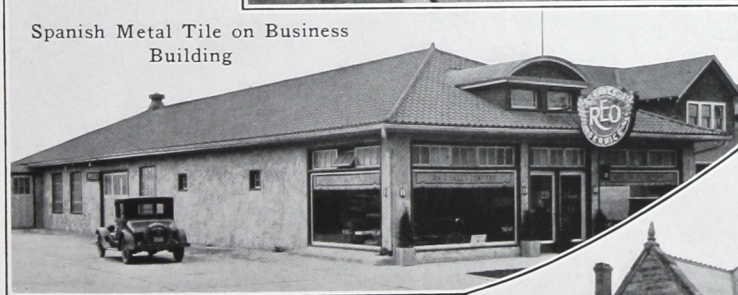
Simplicity provides beauty in
this roof of Spanish Metal Tile



Spanish Metal Tile
Roof adds attrac-
tiveness to this
residence.



Spanish Metal Tile on Business
Building



Metal Shingles have served on
this roof for 37 years

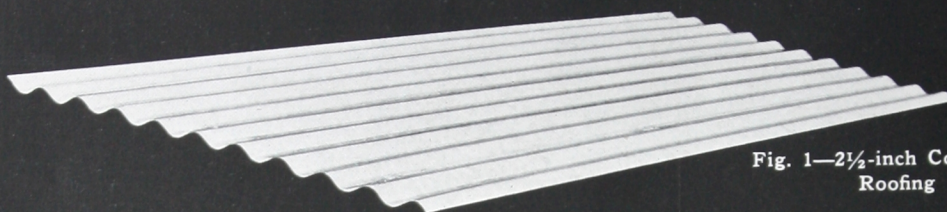


Fig. 1—2½-inch Corrugated Roofing

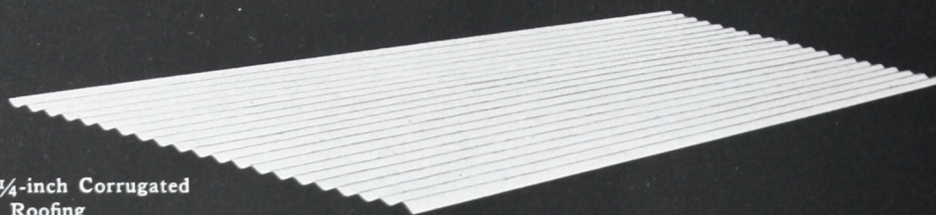


Fig. 2—1¼-inch Corrugated Roofing

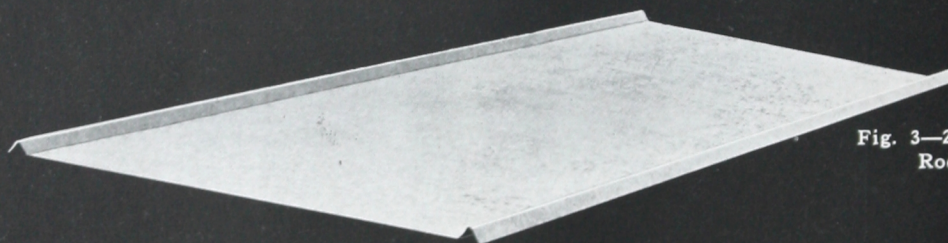


Fig. 3—2 V-Crimp Roofing

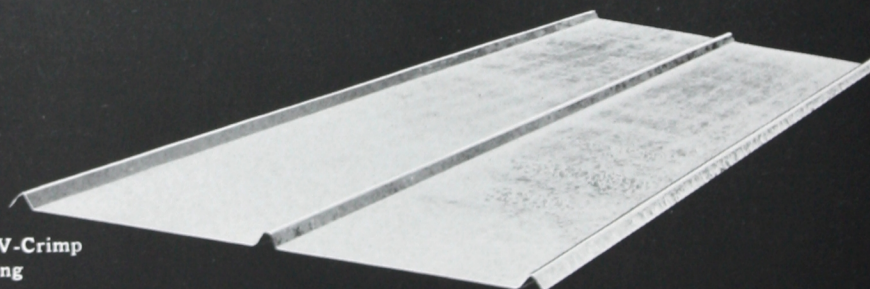


Fig. 4—3 V-Crimp Roofing

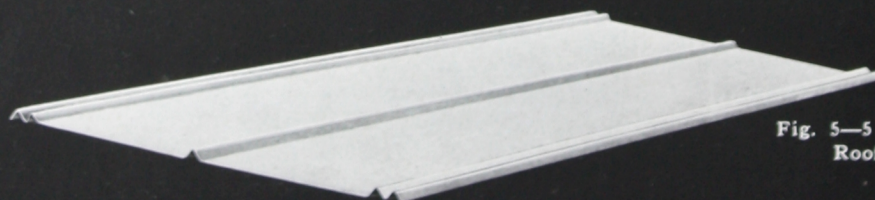


Fig. 5—5 V-Crimp Roofing

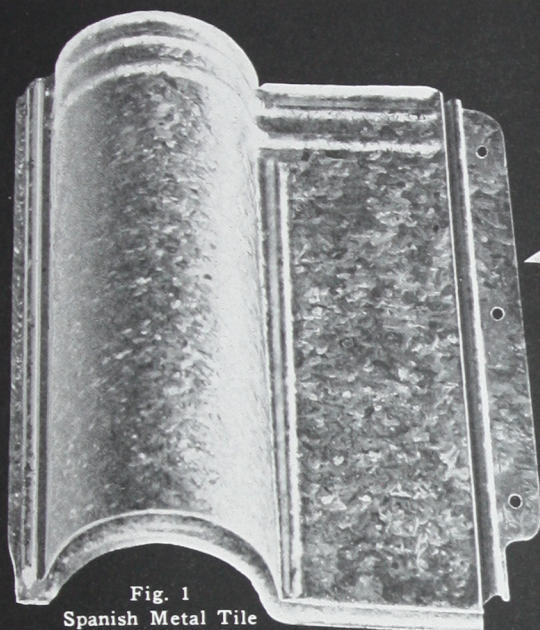


Fig. 1
Spanish Metal Tile

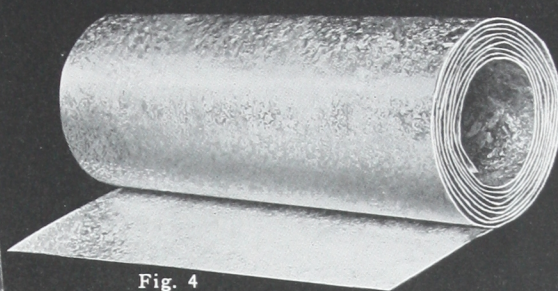


Fig. 4
Roll Roofing

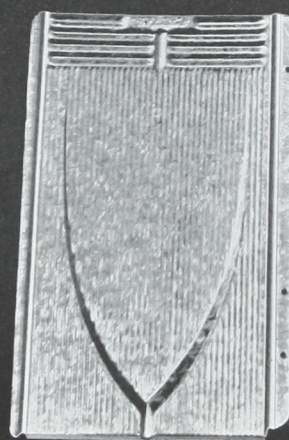


Fig. 2
Metal Shingle

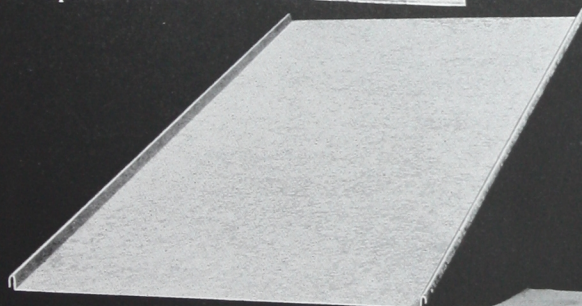


Fig. 3
Pressed Standing
Seam Roofing

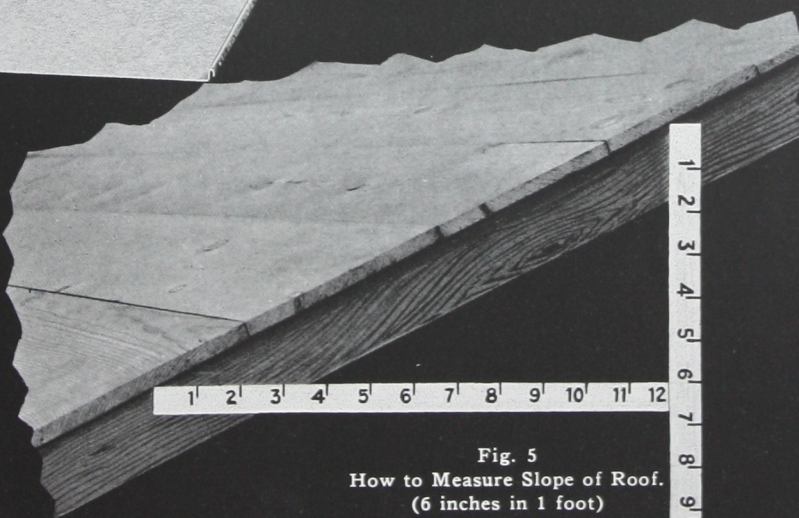


Fig. 5
How to Measure Slope of Roof.
(6 inches in 1 foot)

When this seam is again folded over on itself the type is known as Double Standing Seam Roll Roofing.

Metal Shingles, another widely used type of steel roofing, are illustrated in Fig. 2, page 19. The edge of one shingle interlocks with the groove or edge of the shingle previously laid, and the second edge is held fast by nails. The bottom of the shingles lap over the top edge of the lower course of shingles so that all sides and edges are water tight.

Spanish Metal Tile is another very attractive form of steel roofing, borrowed from Spanish architecture. They have a raised portion looking something like a barrel split in two, and a flat apron on one side. See Fig. 1, page 19. The tile are applied so that the raised or barrel shaped parts fit over the corresponding parts of the tile in under. This results in a series of high and low lines running from the eave to the ridge, and adds to the architectural appearance of the roof. Metal tile are fire resistant, durable and of light weight, about 120 pounds per square. This light weight, in comparison to other kinds of tile roofing, makes possible outstanding economy in the use of smaller timbers in the supporting roof structure.

Slope Determines Type of Steel Roof to Use

The slope or pitch of a roof regulates the speed with which rain water or wet snow drains from its surface, and this slope determines the types of steel roofing best suited for any particular building. This pitch is measured as follows:

Put one end of a rule on the roof as shown on page 19 and hold it level. Measure the vertical distance between the roof and the rule at a point one foot out from that end of the rule which is touching the roof. This will designate the slope of the roof as, for instance, six inches to the foot.

If the roof slopes three inches or more to the foot, then Corrugated, V-Crimped, Pressed Standing Seam, Self-Capping Roll Roofing, Spanish Metal Tile or Metal Shingles may be used. If the roof slopes between three inches and two inches to the foot, V-Crimp, Pressed Standing Seam or Self-Capping Roll Roofing are recommended with the assurance that the slower running rain water or slush cannot seep through the joints. If the roof slopes less than two inches to the foot only Double Standing Seam Roll Roofing is recommended.

Steel Roofing Easy to Apply

The average man accustomed to doing much of his own work will experience no difficulty in applying the more common forms of steel roofing on those roofs that are of simple design. A hammer and pair of extra heavy scissors, commonly called "tinner's snips," are all of the tools needed to lay several of the many styles of steel roofing. This, of course, is a source of economy which is not common to all kinds of roofing.

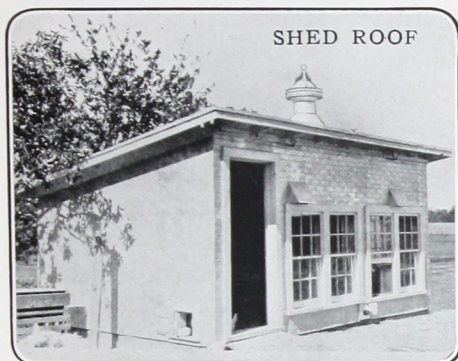
The simpler types of steel roofing are Corrugated, V-Crimp, Shingles, Spanish Metal Tile, Pressed Standing Seam and Self-Capping Roll Roofing. In the case of the latter two types, application is made easier by the use of a pair of flanging tongs to close the standing seams. In case it is found inconvenient to rent, borrow or buy a pair of these tongs, the standing seams can be closed by placing a two inch plank on one side and pounding the seams flat against the plank with a hammer.

The books listed in the preface of this book explain in detail, and illustrate by means of actual step-by-step construction pictures, exactly how to apply any and all types of galvanized steel roofing. A post card request will bring any one or all of these books to you free of cost. With the instructions these books contain, anybody who so desires can apply the more common forms of galvanized steel roofing on all roofs of simple design and be proud of the job.

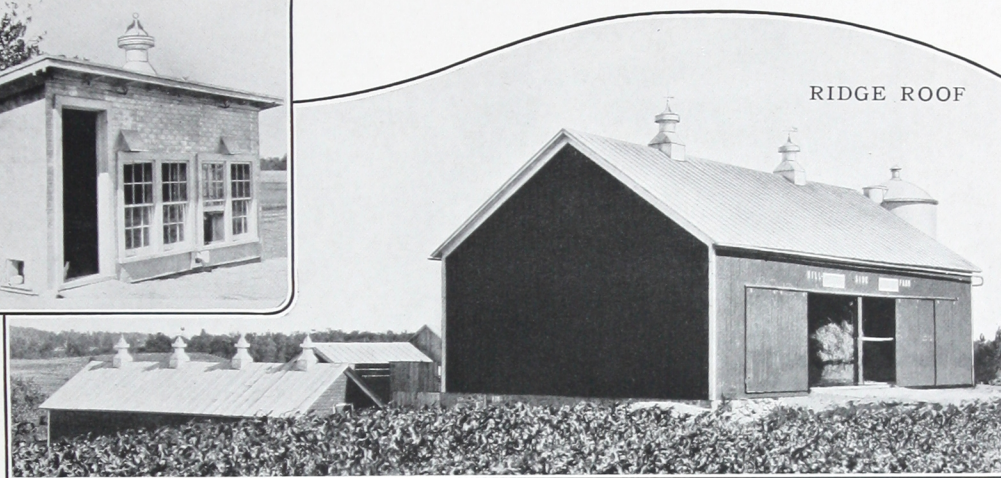
Some of these more simple roof designs are: "Shed," or single pitch roofs; "Ridge," or double pitch roofs; "Ridge," with lean-to shed on one or two sides; "Hip," or cottage roofs; "Ridge," with gable dormer; "L" or "T" shaped ridge roofs and Gambrel roofs. Roofs of these general styles are illustrated on pages 21, 22, 23 and 25. It is readily obvious that on such roofs there are no difficult cutting or fitting operations to puzzle the inexperienced workman.

Roofs Requiring Experienced Help

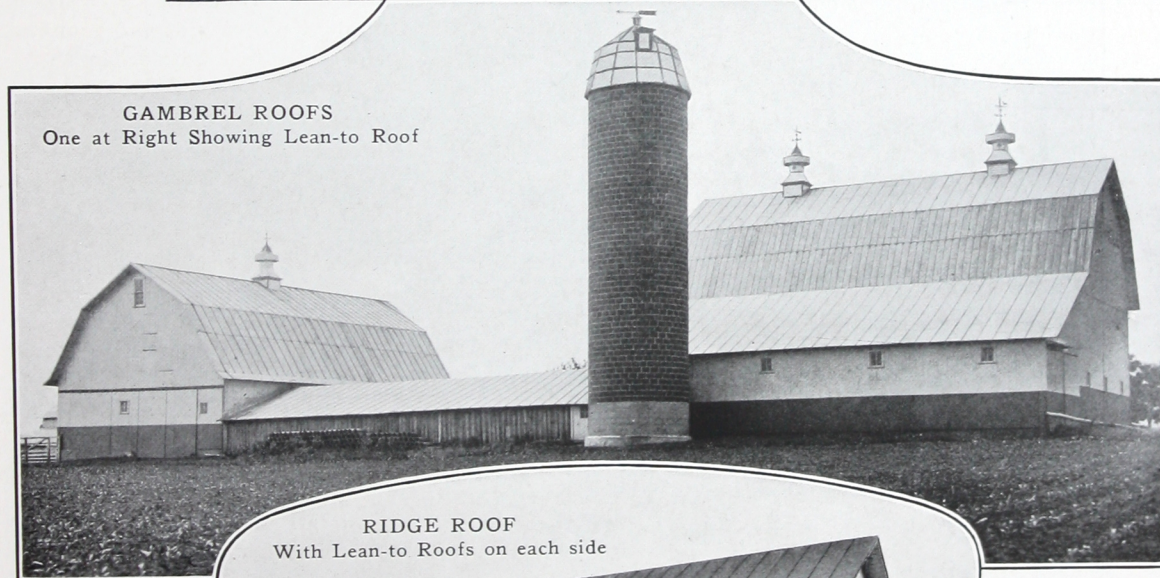
It is inadvisable, with only the common tools and without experienced help, to undertake the covering of elaborately designed roofs. In those cases where the architecture departs too far from the more modest designs it is recommended that a sheet metal contractor, "tinner" or experienced mechanic be employed. On page 27 are illustrations of a few of the more difficult roofing jobs.



SHED ROOF



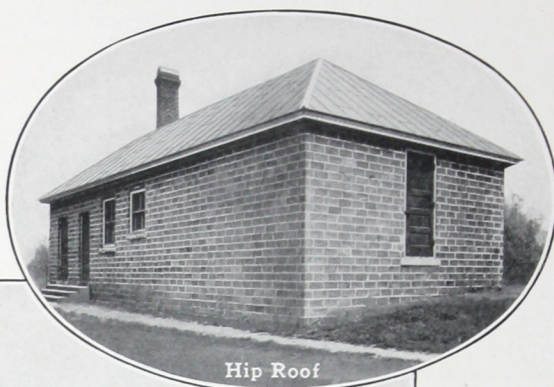
RIDGE ROOF



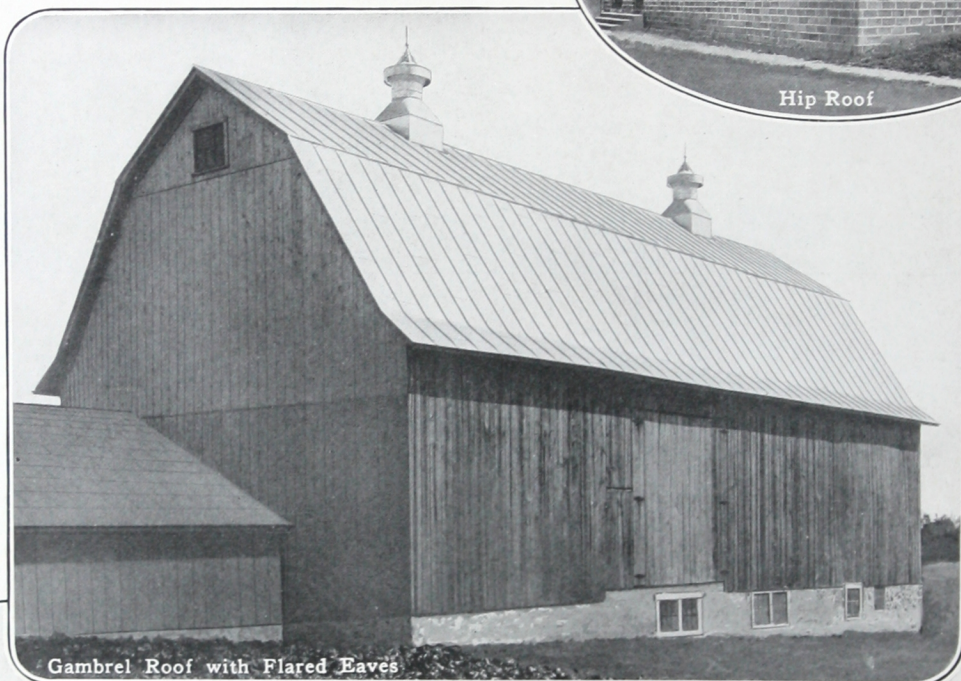
GAMBREL ROOFS
One at Right Showing Lean-to Roof



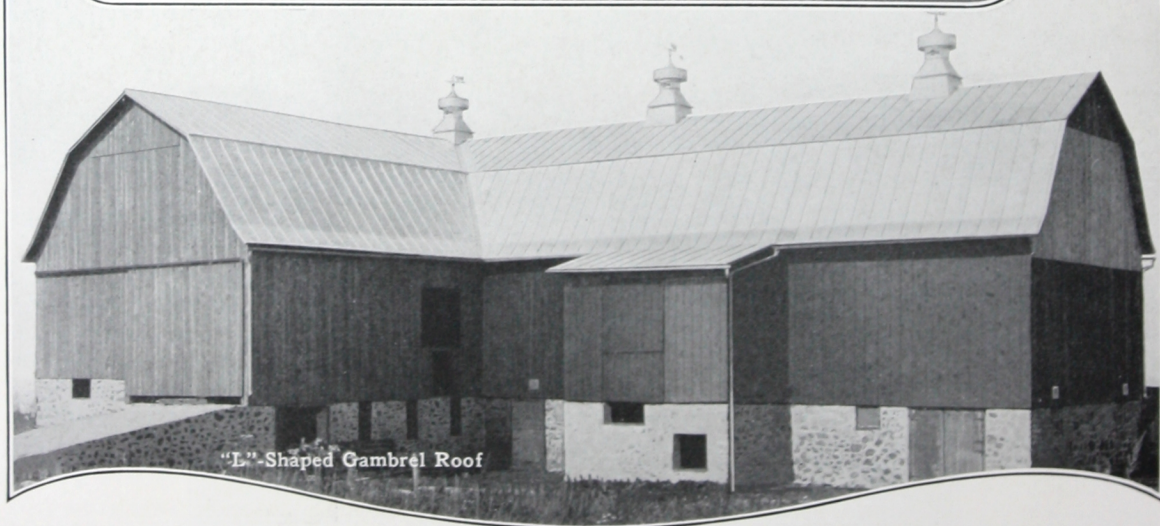
RIDGE ROOF
With Lean-to Roofs on each side



Hip Roof

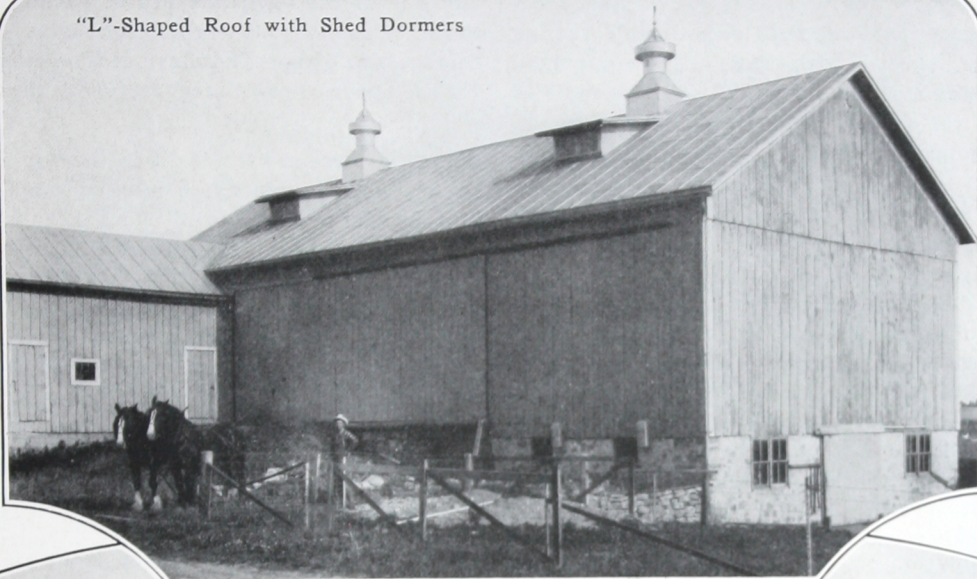


Gambrel Roof with Flared Eaves

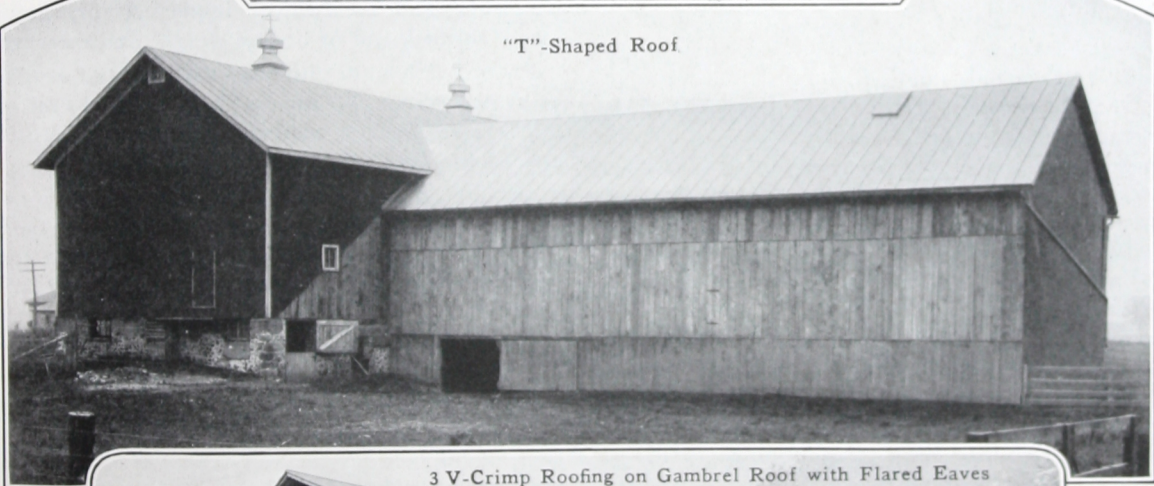


"L"-Shaped Gambrel Roof

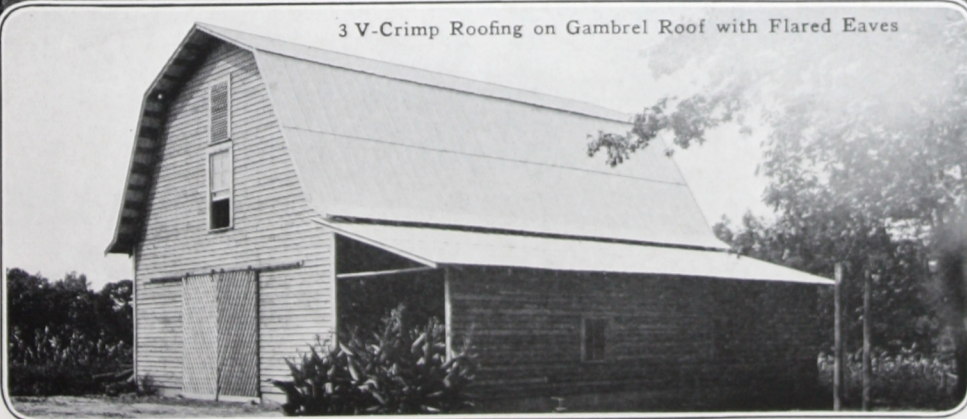
"L"-Shaped Roof with Shed Dormers



"T"-Shaped Roof



3 V-Crimp Roofing on Gambrel Roof with Flared Eaves



To satisfactorily apply some forms of steel roofing on these roofs requires considerable roofing experience, special tools and other equipment. Among these more elaborate and difficult roofs to cover are the Gothic roof, Mansard roof, Round barns or towers, and Silos.

Quality of Roofing to Use

The thickness of either iron or sheet steel is called its gauge. The United States Standard gauge table, established by Congress March 3rd, 1893, is a system of measurement based upon the weight of black iron sheets and plates per square foot of flat sheet. Galvanized sheet steel is thicker and heavier than black iron sheets of the same gauge.

The larger the number of the gauge, the lighter the sheet, and the less it weighs per square foot, whether it be galvanized iron or steel. For instance a No. 16 gauge galvanized sheet is about 1/16th of an inch thick and weighs a trifle more than 2½ pounds per square foot, while a No. 28 gauge galvanized sheet is 1/64th of an inch thick and weighs only 3/4ths of a pound per square foot.

Sheet steel mills sometimes roll and galvanize sheets that are meant to be used for interior purposes where light weight and thinness may not only be desired, but necessary. Because they are not to be exposed to the elements they may be rolled to a higher gauge, sometimes No. 29 or No. 30 gauge, which means that they are thinner and lighter than, for instance, No. 24 gauge. Here and there, as in every business, is an occasional dealer who buys these sheets under the pretense of wanting them for some interior use. Then, to take advantage of the uninformed buyer, such an occasional dealer may form these thinner sheets into

any one of the various types of roofing and sell them for roofing purposes by misrepresenting the thickness or gauge. Therefore, it is most important for the buyer of sheet steel roofing to demand full weight.

Just as there are windfalls in the apple market, so occasionally are there slightly imperfect or blemished sheets of galvanized steel for sale which are termed "seconds." While some of these seconds are satisfactory in those manufacturing processes where the blemished parts can be culled out, they should never be used for roofing or siding. Always insist on "prime" sheets.

Just as there is an occasional unscrupulous dealer who may try to sell under-weight sheets as No. 1 quality, so is there an occasional unscrupulous dealer who may endeavor to sell "seconds" as "prime" roofing or siding material.

Prime sheets should be free from all surface blemishes and mechanical imperfections, accurately formed, and of honest weight and measure.

Roofing is bought either by the hundred weight or by the square. A "square" is 100 square feet of the formed product without allowance for either side or end laps.

The list of three gauges, taken from the accepted table of weights for formed sheets and shown at the bottom of this page, will assist the buyer in determining whether he is receiving full weight material.

Due to unavoidable conditions of manufacture a slight variation in the weight of sheets is allowable. Good mill practice will keep this variation within 2½ per cent. heavier or lighter in any substantial shipment.

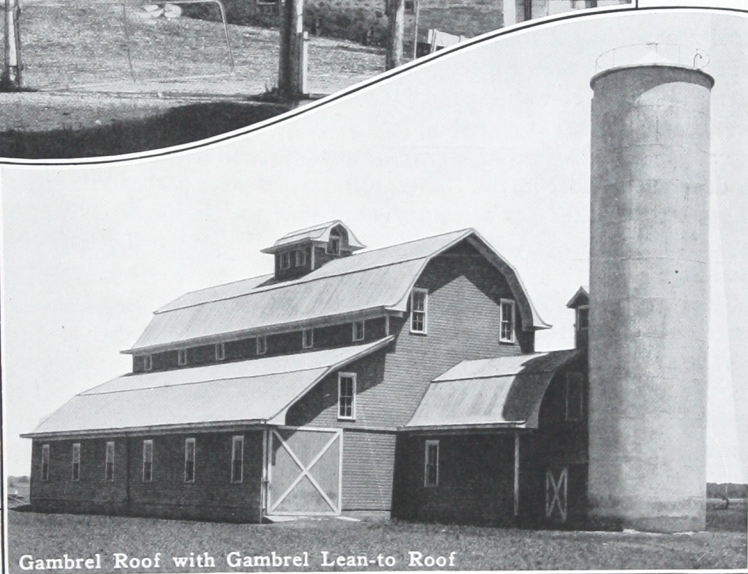
Formed Galvanized Roofing Sheets

Standard weights in pounds per square
(Weight of bands not included)

PRODUCTS	GAUGE		
	28	26	24
2½ in. Corrugated Siding (26 in. wide).....(per square)	84 lbs.	98 lbs.	125 lbs.
2½ in. Corrugated Roofing (27½ in. wide).....(per square)	85 lbs.	99 lbs.	126 lbs.
1¾ in. Corrugated (25 in. wide).....(per square)	88 lbs.	102 lbs.	130 lbs.
1¾ in. Corrugated (26 in. wide).....(per square)	84 lbs.	98 lbs.	125 lbs.
Two V-Crimped, without Sticks.....(per square)	85 lbs.	98 lbs.	125 lbs.
Three V-Crimped, without Sticks.....(per square)	86 lbs.	100 lbs.	128 lbs.
Four V-Crimped, without Sticks.....(per square)	90 lbs.	104 lbs.	133 lbs.
Five V-Crimped, without Sticks.....(per square)	91 lbs.	106 lbs.	135 lbs.
Pressed Standing Seam, without Cleats.....(per square)	86 lbs.	100 lbs.	128 lbs.
Roll Roofing, without Cleats.....(per square)	88 lbs.	102 lbs.	130 lbs.



"L"-Shaped Ridge Roof



Gambrel Roof with Gambrel Lean-to Roof



Ridge Roof with Gable Dormer

The Sheet Steel Trade Extension Committee recommends that under no circumstances should galvanized sheets lighter than No. 28 gauge be used for roofing purposes. This same recommendation is made by the Bureau of Standards, United States Department of Commerce, through its Division of Simplified Practice.

Lighter gauges are found to be unsatisfactory for roofing purposes. In other words, the material is too thin to provide the long life desired in a roof, particularly where climate is severe. When this very thin material is used for roofing in severe climates, it frequently reflects discredit to sheet steel roofing in general.

If an attempt were made to wrap a bushel of field corn in a piece of tissue paper, it would be no reflection on the quality of the paper if it tore. Tissue paper serves admirably in its proper place and so does sheet steel in the lighter gauges. A piece of steel best suited for a lamp shade could not be expected to serve as long on a roof as it would on the lamp.

Steel of No. 28 gauge or heavier and properly coated gives excellent results in roofing.

When steel sheets are put through the galvanizing process to coat them with zinc, the zinc penetrates the outer surface of the metal. This provides a roofing material which has the strength of steel plus the weather resisting properties of zinc.

Upon closely studying such a galvanized sheet under a powerful microscope—a regular practice in the metallurgical laboratories of all steel manufacturers—one would see in its very center a body of pure steel, on either side of which is an iron zinc alloy and finally, on the exposed surfaces, a coating of pure zinc. This makes it clear why heavier sheets carry heavier coatings and is the basis

for the recommendations against the use of too light and thin a material.

Let us repeat, *the smaller the number of the gauge the thicker the steel*. Like sole leather, the thicker the steel, the longer it will last.

The biggest part of the cost of any roof is the cost of labor, whether you do the work yourself or hire it done. This labor cost is practically the same whether you use No. 28 gauge or No. 24 gauge steel. The few extra dollars required for the better quality of material will be returned to you many times over in trouble-free service.

Where to Buy Galvanized Steel Roofing

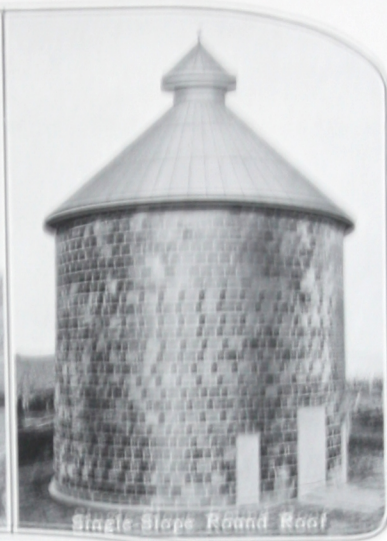
Because the popular demand for the many forms of steel roofing extends from coast to coast and recognizes no international boundaries, time has served to effect so wide a distribution of the material that it is readily available in even the most out-of-way towns and villages.

In any community boasting a sheet metal shop, hardware dealer, lumber dealer, building supply dealer or general country store can be found the more common forms of steel roofing. Prospective users in still more isolated communities can order by mail any desired amount of any particular style of steel roofing from the dealer in the nearest town and feel certain their orders will be given prompt and careful attention.

In those rare cases where your local metal shops, hardware, lumber or building supply dealer cannot supply any desired type of steel roofing, a post card or letter addressed to the Sheet Steel Trade Extension Committee, Oliver Building, Pittsburgh, will receive instant response.



Mansard Roof with Gable and Shed Dormers



Single-Slope Round Roof



*Gothic Roof with Flared Eaves
and Shed Dormer*



Round Barn with Silo in Center



Silos with Double-Slope Roofs and Gable Dormers

The Sheet Steel Trade Extension Committee wishes to acknowledge the courtesy of the following in furnishing several photographs reproduced in this book: Lyon Conklin Company, Inc., Baltimore, Md.; Milwaukee Corrugating Company, Milwaukee, Wisc.; National Fire Protection Association, Boston, Mass., and Member Companies.

